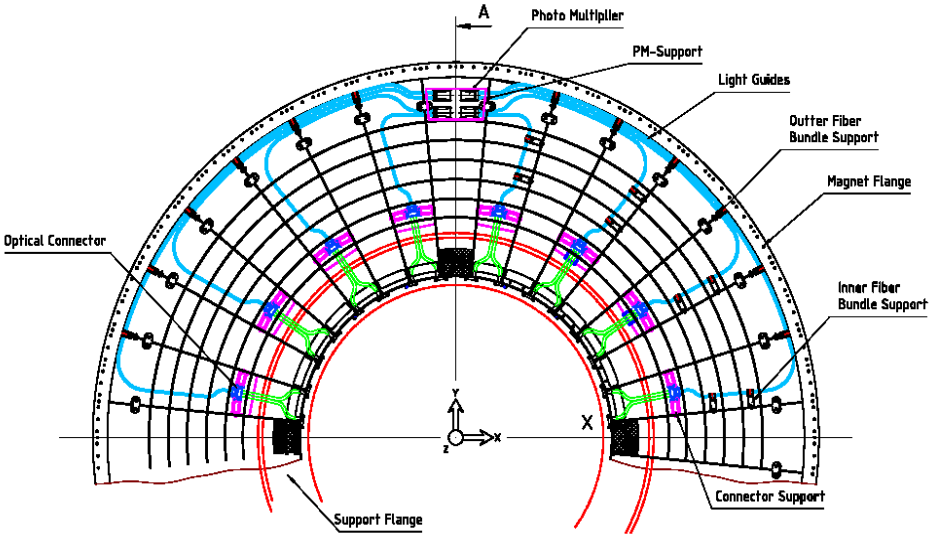
ACC for AMS02

M. Fernandez-Garcia, W. Karpinski, K. Lübelsmeyer, St. Schael, R.Siedling, W. Wallraff



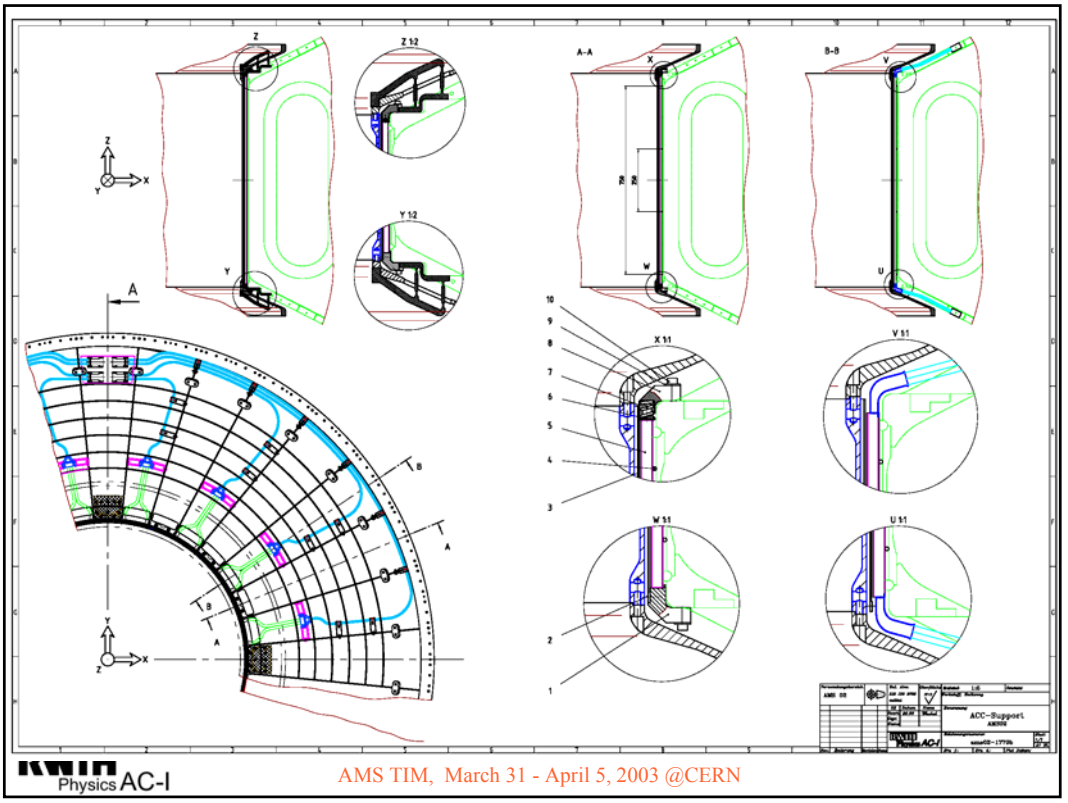
ACC for AMS02

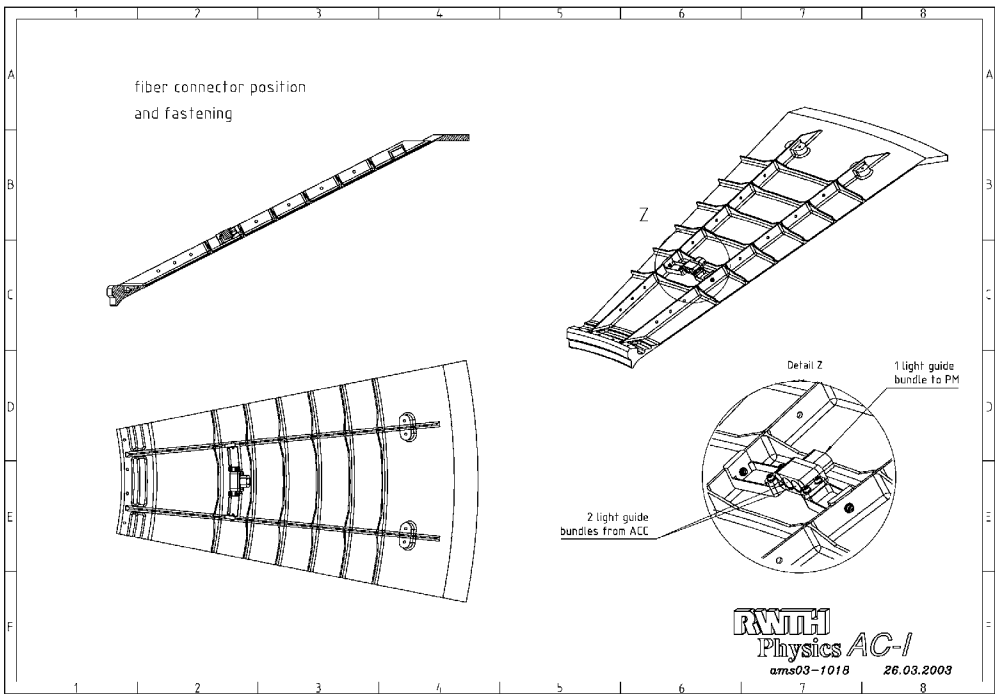
- **Scintillator barrel of 16 scintillators readout by WLSF coupled to16 photomultipliers.**

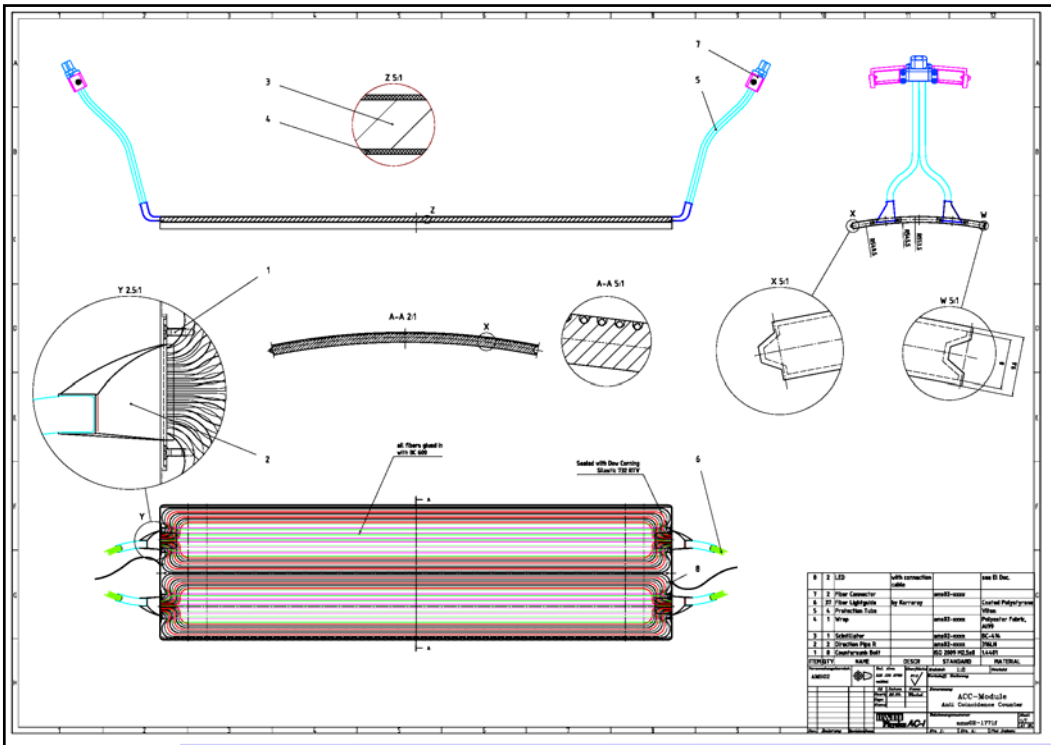
- **Scintillator: Kuraray (SCSN-81), 8 mm thickness**
  WLSF: Kuraray Y-11(200) M
  PM: Hamamatsu fine mesh R5946

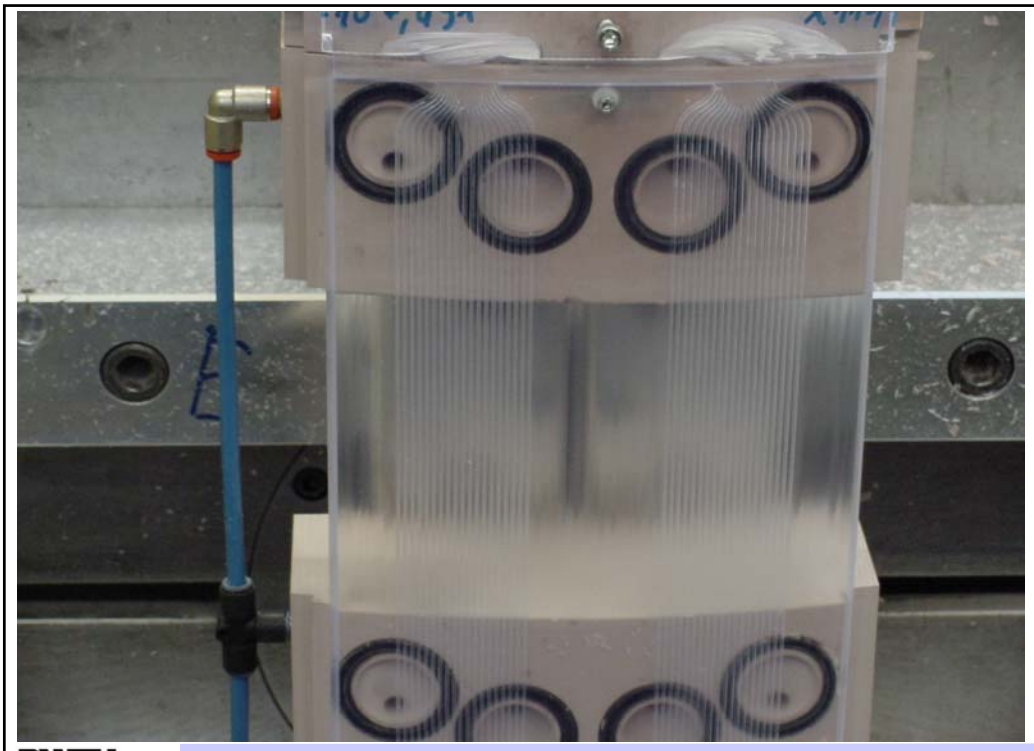
	AMS1	*AMS2*
Scintillator	BC-414	Kuraray SCSN-81
Thickness	10 mm	8 mm
λ_{Max}	392 nm	440 nm
Decay time	1.8 ns	2.5 ns
Att length	1 m	1.40m
WLSF	Kuraray Y-11(200)M	
Absorption	350-470 nm	
$\lambda_{Emission}$	476 nm	
Att. Length	>3.5 m	
Clear Fiber		BCF-98
Att. Length	—	>3m
		Double Cladded
PM	Hamamatsu R5900	Hamamatsu R5946
Spectral response (QE>10%)	300-500 nm, 420 nm Max	320-520 nm, 420 nm
Type	"Metal channel Dynode"	Fine mesh
# Dynodes	10	16
Gain @ 0 Tesla, 0 deg	$2x10^6$@900V	$1x10^6$@2000V
Gain @ 0.3 Tesla, 0 deg	Useless above 0.3T	$0.9x10^6$@2000V

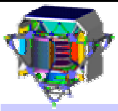
RWTH Physics AC-I
AMS TIM, March 31 - April 5, 2003 @CERN


Z
Z 1:2
Y 1:2
A-A
B-B
A
X 1:1
V 1:1
W 1:1
U 1:1
ACC-Support

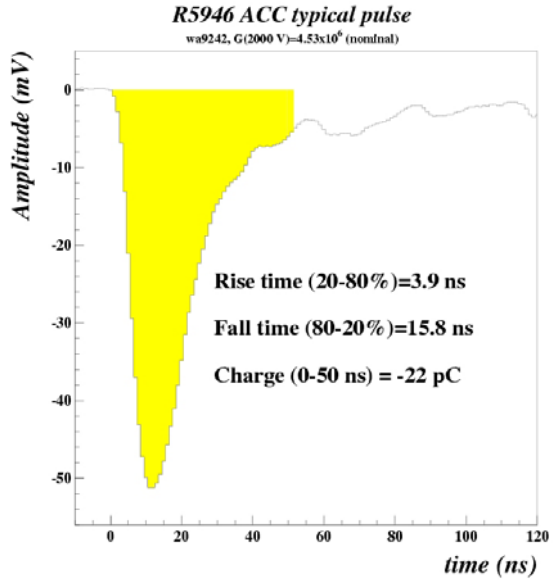

fiber connector position
and fastening
Z
Detail Z
1 light guide bundle to PM
2 light guide bundles from ACC
RWTH Physics AC-I
ams03-1018
26.03.2003


Z 5:1
Y 2.5:1
A-A 2:1
A-A 5:1
X 5:1
W 5:1
ACC-Module



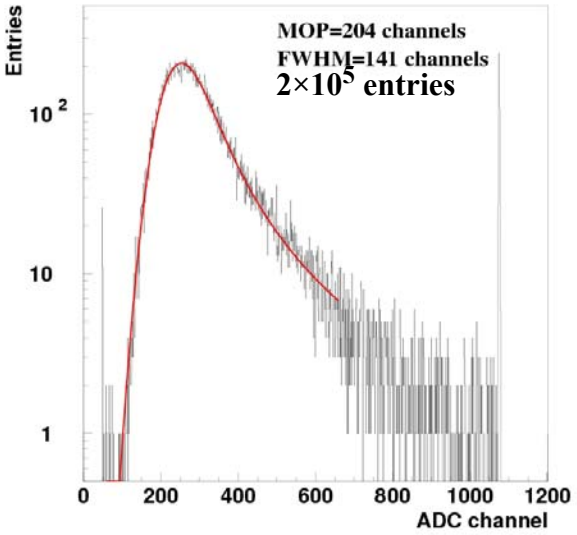


ACC typical signal



- Fine mesh tube operated at 2000 V (gain~5×10^6)
- Pulse shows average of 100 perpendicular singly charged MIPs

Methods to calculate PM gain



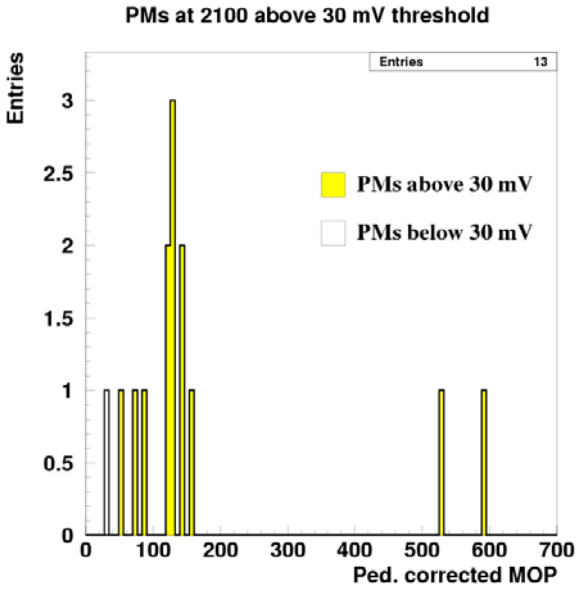
- Ideal PM:

$$\left.\begin{array}{l} N_a = N_{pe} \cdot G \\ N_{pe} \text{ is poisson distributed} \\ \Rightarrow \sigma_a = \sqrt{N_{pe}} \cdot G \end{array}\right\} \Rightarrow G = \frac{\sigma_a^2}{N_a}$$

- Width can be the Landau width (overstimates G) or LED width at MOP
- Gain can be calculated from a single electron entering the dynode chain

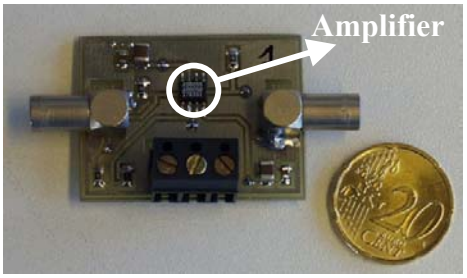
PM R5946 figures

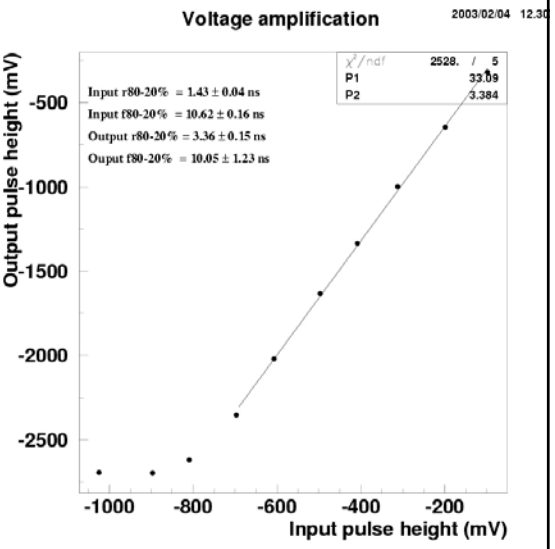
- 13 PMs (out of 21 tested up to now), have nominal gain at 2000 V above 5×10^6
- Only 1 PM (at 2100 V) could not overcome 30 mV threshold, using cosmics



Signal budget

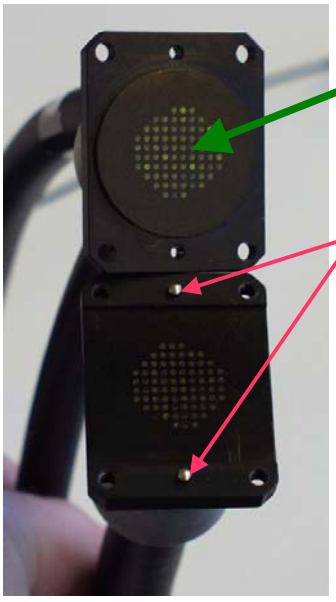
- Small amplifier AD8055 (input ×3) at the input of the SFEA (5 mA on ± 5V)





- 75% signal to the discriminator
  20% signal to history channel
  5% signal to the ADC

Light coupling performance



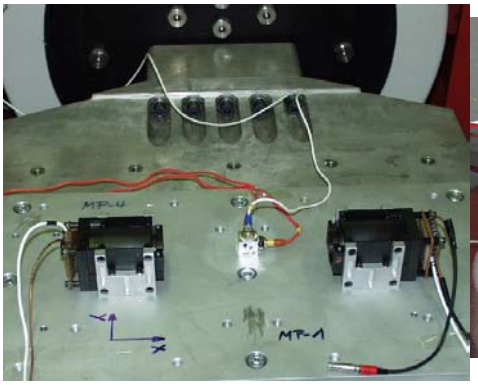
- Clear Fibers used to reach PMs on the 0.2 T region.

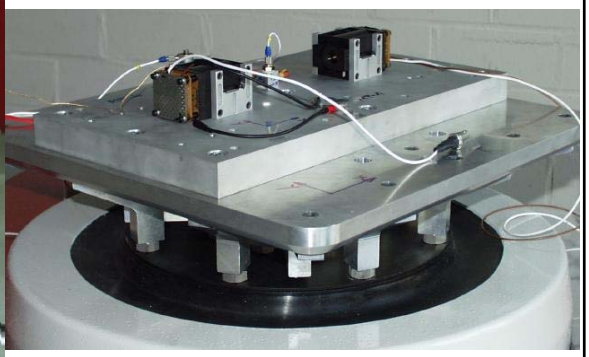
- Two prototypes built and tested. Good geometrical matching between fibers achieved by using precision pins

- Preliminary results show
  15% loss/connector
  Namely:
  10% reflectivity loss,
  5% coupling inefficiency

Space Qualification Tests

Mechanical Vibration Setup @Aachen





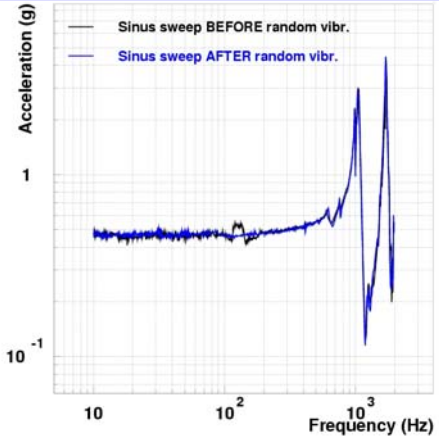
Test Series
Sine -Random -Sine
in 3-D orientations

→

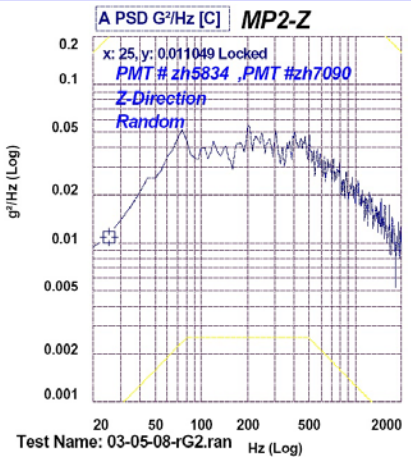
Sine Vibration
(10 ~ 2000 Hz, with const acceleration 0.5 g)
Random Vibration
(Peak vibration level of 0.04 g^2/Hz from 80 ~500 Hz, 90s)
g_{RMS} = 6.8 g

Space Qualification Tests

Mechanical Vibration Mode

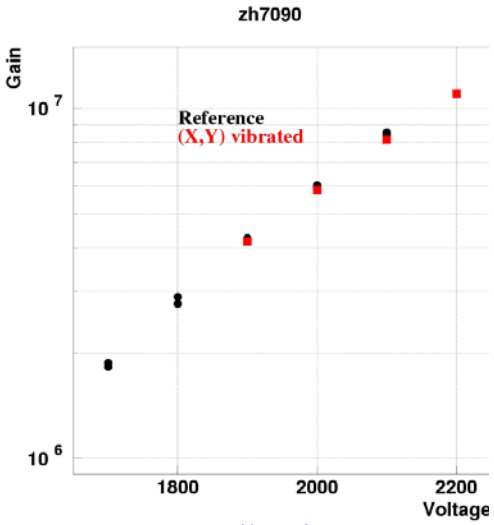


Sine Acceleration Mode
Distinct resonance occurs at a frequency close to a natural frequency of ~ 1000Hz

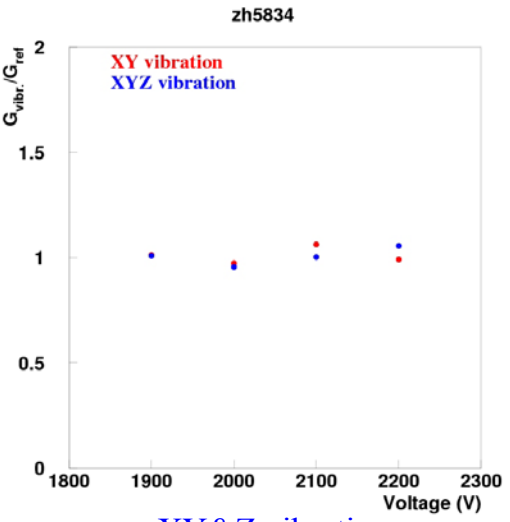


Random Acceleration Mode
g_{RMS} = 6.8 g
Peak vibration level of 0.05 g^2/Hz from 40 ~ 500 Hz with test durations of 90 s

R5946 PM performance
after vibration



XY vibration



XY&Z vibration